The Measurement and Evolution of Health Inequality: Evidence from the U.S. Medicare Population

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Abstract

What has been the evolution of health-related inequality in the United States in recent years? When inequality is measured by health care expenditures, the evidence from the over-65 population in the United States suggests that Medicare has become more progressive. During 1987-2001, low income households experienced an increase of 78 percent ($2624) in per capita Medicare expenditures, double the increase of 34 percent ($1214) in the highest income group. However, we find the opposite pattern when inequality is measured using life expectancy: expected survival in the lowest income decile grew by 0.2 years during the 1990s, compared to an improvement of 0.8 years in the highest income group. That these two measures deliver such different messages may not be entirely surprising given their shortcomings in reflecting the inequality of health care systems. We suggest a new approach to quantifying income-based health care inequality: the use of effective health care measures where the efficacy is well proven and nearly 100 percent of the relevant population should be receiving it, regardless of health status or preferences. Using Medicare claims data matched to zip code income, we find distinct differences across income groups in the use of mammography screening, diabetic eye exams, and the use of ß blockers and ACE inhibitors following heart attacks, and these differences appear to be stable or growing slowly over time. In sum, the rapid growth in health care expenditures for the elderly, particularly among the lowest income groups, has done little to reduce income-based health inequality.

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The technological revolution in health care has brought both great benefits with respect to survival and general well-being, and substantial increases in costs (e.g., Cutler et. al., 1998; McClellan and Cutler, 2002; Skinner, Staiger, and Fisher, 2004). Whether these changes have reduced inequality in health care or in health outcomes is not well understood. Earlier research suggested that medical care innovations, such as the use of antibiotics in the treatment of tuberculosis, reduced health care disparities by race (McDermott, 1978). On the other hand, studies of health care expenditures by income group found higher income groups accounting for a larger fraction of spending, particularly after accounting for health status,[1] although more recent U.S. data by educational group suggests a different pattern (Battacharya and Lakdawalla, 2004). Recent studies also suggest that better educated patients get access to newer drugs (Lleras-Muney and Lichtenberg, 2002), survive longer following the diagnosis of cancer (Glied and Lleras-Muney, 2003) and comply better with regimens for the treatment of AIDS (Goldman and Smith, 2002).

This paper returns to the question of whether technological advances and increases in health care expenditures have been associated with a widening or a narrowing of inequality in health or in health care. The group studied is the over-65 population in the United States during the 1990s, which is of particular interest given people in this age group consume such a large fraction of health care resources relative to the rest of the population. Initially, two conventional measures of inequality are considered: health care expenditures and health care outcomes as measured by 10-year

[1] See for example LeGrand (1978, 1982), Le Grand et. al. (2001), Wagstaff et. al., (1991), Davis and Reynolds (1975), Link, Long, and Settle (1982), and McClellan and Skinner (2004). Some studies find more nuanced patterns, for example Gittelsohn, Halpern, and Sanchez (1982) and Morris, Sutton, and Gravelle (2003).

survival rates. Using detailed Medicare claims data on a panel of several million people in the over-65 population in the United States stretching back to 1989, we matched each individual to an income group based on median income in their zip code of residence. Between 1987 and 2001, we found a dramatic increase in health care expenditures among the lowest income groups, accounting for an increase of 78 percent ($2624) in real terms during the period 1987-2001, compared to a 34 percent increase ($1214) for those in the top income decile. Using expenditures as a marker for health inequality, one would conclude that inequality has lessened, and if anything the higher (annual) expenditures for lower income households would help to compensate for earlier years during which insurance coverage and preventive care was minimal (Card, Dobkin, and Maestas, 2004).

There are a variety of disadvantages to using expenditures for health care as a measure of access, however. Expenditures may reflect preferences as well as access to care, nor is it clear how expenditures on health care translate into health outcomes (e.g., Fisher et. al., 2003a,b). Indeed, much of the differential increase in expenditures during this period was accounted for by home health care, a program in which 40 cents of every dollar was spent "inappropriately" according to one government investigation (Havemann, 1997).

A different picture emerges in considering the evolution of health care outcomes as measured by 10-year survival rates. While each income group experienced a survival gain during the 1990s, those in higher income groups did better: life expectancy rose by 0.2 years in the bottom income decile compares to 0.8 years in the top income decile. But this measure is not immune from criticism either. Individual decisions regarding healthy behavior exert an important influence on health outcomes over the life-course,

and it is rarely clear whether these choices should be attributed to "preferences," education, or economic status *per se* (Graham, 2002; Contoyannis and Jones, 2004; Smith, 2003. As well, long and variable lags in outcomes makes it difficult to evaluate the impact of the current health care system on changes in current health outcomes, particularly when income itself is endogenous to health status (Case and Deaton, 2003).

That the two measures of health inequality arrive at directly opposite conclusions is suggestive of the need for a different approach to measuring health inequality. We focus on a more limited set of *effective* (or high-quality) utilization measures, procedures with well-established benefits so that preferences for care should play a secondary role.[2] These measures include mammography screening among women age 65-69, eye examinations for diabetics, and aspirin, ß-blockers, smoking cessation advice, and reperfusion in the first 12 hours following the heart attack, treatments that accounted for nearly all of the improvement in survival following heart attacks (Heidenreich and McClellan, 2001).[3] Nor does one need to adjust for preferences or health status across income groups, since among ideal or appropriate patients, the target rate approaches 100 percent regardless of income or demographic group.[4] These health care quality measures also avoid the most serious problems inherent in outcomes measures, since they do not depend on other factors (genetic, lifestyle, etc.) that might exert an independent influence on outcomes.

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[2] This terminology follows that in Wennberg et. al. (2002).

[3] These measures are used commonly in the clinical literature to measure quality of care, for example see Jencks (2003).

[4] Although for screening programs see Walter et. al. (2004).

Using the Medicare claims data augmented with the Cooperative Cardiovascular Project (CCP) data for heart attack patients in 1994/95, we find distinct income gradients with regard to the use of effective care. For mammography, examination rates for the top income decile were 16 percentage points higher in 1993, and by 2001 the gap had shrunk only slightly to 15 percentage points. For the inpatient treatment of heart attacks in 1994/95, where the use of effective care is unlikely to have any incremental impact on patient costs and where noncompliance is minimal, the income gradients are smaller; 7 percentage points for ß blockers and 5 percentage points for the use of ACE inhibitors, with no significant differences in aspirin use. Even these income gradients should be interpreted with caution; for ß Blocker use, half of the income gradient is the consequence of where low income people live (a larger fraction reside in regions with lower overall quality rates) rather than their relative income within a region.

In sum, the dramatic increases in relative Medicare expenditures for low income neighborhoods during the past several decades have not translated into similar improvements in health outcomes. Of course, there are a variety of reasons why the two measures may move in opposite directions. But the apparent lack of improvement in effective care measures among the lowest income groups – despite the dramatic increase in expenditures – makes this discordance much less surprising.[5] The policy implications are straightforward, however. Monitoring and improving the quality of care through the use of effective care at its "ideal" level of near 100% for appropriate candidates would have the additional and desirable effect of reducing income-based inequality in health outcomes.

[5] Baicker and Chandra (2004) have also shown this lack of association between Medicare expenditures and effective care measures at the regional level.

1. The Measurement of Health and Health Care Inequality

It is important to distinguish between inequality in health care and inequality in health. There is a long history of measuring inequality in health care by the use of utilization or expenditures measures.[6] Le Grand (1978, 1982) and others found a positive gradient between expenditures and income after controlling for measures of health status in the United Kingdom, even after several decades of National Health Insurance. While there was a lively debate about how best to measure income-based gradients in health care (e.g., Wagstaff et. al., 1991, Le Grand, 1991), the positive association between expenditures and income has been found in many countries with just a few exceptions (Wagstaff et. al., 1991). The earlier evidence from the United States pointed towards the same positive association between expenditures and income (Davis and Reynolds, 1975; Link, Long, and Stettle, 1982), although more recent data on Medicare expenditures in the 1990s suggests that a "twist" may have occurred where lower income households began to account for higher levels of spending.[7] We consider this "twist" in more detail below.

The interest in illness-adjusted expenditures or utilization can be motivated by a concern about access to care, where the null hypothesis of perfect equality is presumably one where high income and low income individuals with similar medical ailments would be treated with the same procedures and with the same degree of intensity. But several authors have questioned whether equal rates of utilization are really the same as equal access, for example if people with high incomes experienced different preferences for care (e.g., Moody et. al., 1991, see Culyer et. al., 1991).

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[6] Le Grand (1978) includes cites to the earlier literature; also see Gittelsohn et. al (1982).

[7] Lee, McClellan and Skinner, 1999; Battacharya and Lakdawalla, 2004; McClellan and Skinner, 2004.

While economists are generally comfortable taking preferences as given, the issue is more nuanced in the health care literature. For example, Irbrahim, et. al. (2001, 2002) documented more distrust of surgery among black candidates for hip or knee replacement, and placed greater reliance on alternative (non-surgical) approaches such as copper bracelets or prayer. Katz (2001) has distinguished between preferences "guided by informed decisions" and those "limited by truncated opportunities or historical circumstances." Distinguishing between these two types of preferences in making inferences about inequality would be quite difficult.

Another shortcoming of using health expenditures is that higher levels of expenditures may not translate into better health outcomes. Glover (1938) counseled against the overuse of tonsillectomies at a time when the risk of surgical complications was high. He and his colleagues noted that children of anxious high-income parents were more likely to receive the procedure and hence more likely exposed to the risk of operative mortality. Schneider et. al. (2001) suggested that part of the explanation for the black-white differences in cardiac surgery rates was that white patients experienced rates higher than appropriate. In either case, higher expenditures did not translate into better health.[8]

Health care expenditures have also been used to construct measures of "full income" that include both money income and government-financed health care expenditures. This approach was pioneered by Smolensky and his colleagues at Wisconsin during the 1970s in the study of income distribution (Reynolds and Smolensky, 1976; Moon, 1976), and extended to valuing health care benefits in a money-

[8] More generally, Fisher et. al. (2003a, b) has suggested that regions with greater use of health care were no more likely to experience better outcomes or even improved satisfaction of patients and access to care.

metric context (Smolensky, et. al., 1977). More recently, Fuchs (1999, 2001) has used this approach to document the very large fraction of full income among the elderly in the U.S. comprising health care expenditures, most of which is paid for by younger generations. The implicit message in creating full income measures is the opportunity cost of health care spending, that a modest reduction in health care spending could have a large impact on money income, particularly among low income groups. In the analysis below, we follow in the spirit of this approach by comparing the evolution of median money income with health care expenditures.

In the past decade, there has been an increasing interest in the inequality of health, whether measured as lifespan, quality-adjusted life years, healthy life years, or self-reported health.[9] Measuring health outcomes avoids the problem of inferring the effectiveness of health care expenditures on outcomes. It also has the advantage of capturing income-based differences in a variety of factors such as health behavior, diet, and life-course events that have a larger impact on health outcomes than the health care system alone. The results are if anything quite a bit stronger, exhibiting a uniform and consistent gradient between income and health care outcomes.

Inequality in health outcomes can be present even in the absence of inequality in health care. Suppose that the health care system were perfectly fair, and provided instant access at minimal price to all people in society. Inequality in outcomes could occur for a variety of reasons. The first is simply luck or genetic differences across the population (Gakidou, Murray, and Frenk, 2000), conditional on income and other factors. However,

[9] Berloffa, Brugiavini, and Rizzi, 2003; Case and Deaton, 2003; Contoyannis and Jones, 2004; Elstad and Krokstad, 2003; Gakidou, Murray, and Frenk, 2000; Glied and Lleras-Muney, 2003; Goldman and Smith, 2002; Preston and Taubman, 1994; Van Doorslaer, et. al., 1997; Wagstaff and van Doorslaer, 2004.

most summary measures of income-based health inequality remove this source of inequality by averaging over large numbers of individuals. For example the "concentration index" compares the cumulative distribution of income on the horizontal axis, and the cumulative distribution of healthy life years (however measured) on the vertical axis, thereby averaging out variation occurring within income categories.[10]

The second source of inequality could occur because of differences in health behavior such as diet, smoking, exercise, drinking, and other factors associated with income and socioeconomic status, so that "... inequalities in health reflect the wider inequalities in society." (Le Grand, 1982, p. 45.) For example, Contoyannis and Jones (2004) report that these measures of "healthy living" in 1984 were strong predictors of positive good health in 1991. Of course, this raises the very difficult question again of how one can separate "preferences" for health-related behavior from income *per se*.

The third reason why income-based inequality may arise is in the context of a model where income and health outcomes are each determined by early childhood opportunities. Almond (2003) has shown that the influenza epidemic of 1918 led to a long-term negative impact on both mortality and earnings for the cohort who were *in utero* during the epidemic. This by itself could have generated an income-survival gradient in the absence of other factors. As well, models in which characteristics of the individual, perhaps intrinsic or affected by socioeconomic status, class, race, and other factors, jointly determines both earning capacity and health (and its depreciation, Case

[10] The measure of inequality is then calculated much like the Gini coefficient; for a general discussion of health inequality decompositions, see Contoyannis and Forster (1999) and Wagstaff and van Doorslaer (2003).

and Deaton, 2003), muddying the causal link between income and health outcomes even further (Elstad and Krokstad, 2003, Graham, 2002).

Given our focus here on health care rather than on the host of income-related behaviors determined over the lifecourse, we suggest a more restrictive and "cleaner" measure of health care utilization that avoids many of the previous shortcomings. As well, it preserves the rational for measuring inequality on the basis for income rather than education or some other marker for socioeconomic status. Since income is the best indicator of how much one pays into the health care system, one can compare it directly with the quality of services provided through (in this case) the Medicare program.

We measure utilization rates of effective care, treatments for which nearly 100 percent of the population should be receiving the treatment, and its efficacy is well proven. Examples include mammography screening for women aged 65-69, and ß blocker, aspirin, reperfusion therapies, and ACE inhibitor use for appropriate heart attack patients.[11] These types of measures have also been used in the development of health quality "report cards" such as HEDIS measures. As well, measures such as mammography have been adopted in other studies with implicit recognition of their effectiveness (Decker and Rapaport, 2002; Card, Dobkin, and Maestas, 2004).

There are several advantages in using these measures. The first is a reliable link between utilization and health outcomes. Second, there is no need to control (however imperfectly) for health status, since among appropriate or ideal patients, nearly everyone should receive the treatment. Finally, preferences should generally not play a strong role

[11] Reperfusion therapy (12-hour angioplasty or "clot busting" thrombolytics) is effective at removing the blockage or clots restricting blood flow to the heart. Aspirin is effective at breaking down platelets that are essential components of these clots interfering with blood flow. ACE inhibitors attenuate the body's natural tendency to constrict vascular walls, while ß blockers reduce the body's demands on the heart.

in the use of such measures, given that the objective benefits are so much larger than the costs.[12] Before considering these new approaches, however, it is useful first to consider trends in the conventional measures of inequality in the U.S. Medicare population: health care expenditures and survival rates.

2. The Distribution of Medicare Expenditures by Zip Code Income

The Continuous Medicare History Survey (CMHS), a 5 percent sample of every Medicare enrollee, is used to consider the secular trends of overall Medicare expenditures by income decile. Because individual income is not available in the Medicare claims data, we instead use zip code income. There are advantages and disadvantages of using zip code income. On the one hand, zip code income may better reflect permanent income for elderly people, their neighborhood, compared to survey data, since reported income may not reflect wealth ownership and is infested with measurement error and transitory income components. On the other hand, zip code income is subject to "ecological bias," poor Medicare enrollees in rich neighborhoods could be treated differently from rich enrollees in poor neighborhoods, so that zip code income also reflects neighborhood effects. Previous studies have suggested that zip code income provides a reasonable characterization of income in health-related research (see Geronimus, et. al., 1996).

In quantifying health care expenditures for the over 65 population, we express all expenditures in 2001 dollars, and estimate age-sex-specific expenditures in 5-year increments (plus those 85+) for each of 10 income deciles. In presented aggregated data, we use direct adjustment to normalize the per capital Medicare expenditures to a constant

[12] In practice, Walter et. al. (2004) has pointed out that preferences could play a legitimate role for a some patients in the use of screening for new disease. These arguments are harder to make in the case of heart attack treatments; it seems unlikely that anyone should prefer not to take aspirin following a heart attack. Alternatively, one may view the benefits as being sufficiently high to justify paternalistic efforts on the part of the government to encourage such practices.

age composition over time by use of the sample frequencies of the 10 age-sex categories.[13] Because of large sample sizes, it is possible to estimate reliably per capita Medicare expenditures within cell groups despite the presence of outliers. Only fee-for-service Medicare enrollees are included in the sample, which means that expenditures made on behalf of enrollees in Medicare managed care will not be included in this sample.[14]

We use zip code income information based on the 1990 Census, but the results are similar if the 2000 Census income data were used. Table 1 and Figure 1 present expenditures for selected income deciles from 1987-2001. Not surprisingly, real Medicare expenditures have increased during this period. However, the rates of growth by income group are quite different; the bottom decile experienced a 78 percent increase in real expenditures, in contrast to the top decile with just a 34 percent increase.

The advantage of a "full income" measure of income is that these changes in spending can be compared to changes over the same period of time in median money income, as measured in the Current Population Survey. The median increase in family income during the period 1987-2001 was $2551.[15] Assuming an average of 1.5 elderly people per family, this would translate into a per capita increase of $1700. Note that the increase in expenditures for the lowest income decile was $2624, compared to $1214 for

[13] Just the 80+ population is considered in quantifying home health care, and so for this group there are four age-sex categories, males 80-84, males 85+, females 80-84, and females 85+.

[14] Until 1997, managed care organizations were reimbursed for their Medicare enrollees by a capitated fee based on 95% of the lagged value of regional fee-for-service expenditures, so that fee-for-service expenditures within a region would have been a reasonable measure of the managed care capitation fee. While the Balanced Budget Act of 1997 severed that close link, it is not expected that the relatively small fraction of Medicare managed care enrollees would bias these results.

[15] In 2001$, http://www.census.gov/hhes/income/histinc/f11.html.

the highest income group. Thus the size of the "twist" in Medicare expenditures was $1410 ($2624 minus $1214) or the amount of money that would have been left "on the table" had Medicare costs for the lowest income group grown at the same rate as the highest income group. This number is nearly as large as the total increase in median household income during 1987-2001. It is also larger than the average *level* of per capita benefits from the Earned Income Tax Credit (EITC) program, estimated to be $1287 (in 2001 dollars) among the near-poor (Short and Garner, 2002). Unlike the EITC, the redistribution occurring in the Medicare program was largely unintended, and the differential benefits to the lowest income group are still not well understood.[16]

Why the twist? One reason could have been the growth in the Disproportionate Share Hospitals (DSH) program that provided higher reimbursements for hospitals in low income neighborhoods. A larger factor was the rapid expansion of home health care during the 1990s. Beginning in the late 1980s, when restrictions on the use of home health care were eased, there were dramatic increases in the use of home health care particularly in certain regions of the U.S. such as Texas, Florida, and Tennessee (Wennberg and Cooper, 1999). Because of the rapid growth in expenditures, and an accompanying increase in scandals, Congress restricted its use sharply in 1997. These expenditures for home health care were concentrated to a large extent in the poorest zip

[16] One shortcoming with these changes in Medicare expenditures is that we do not have similar data on Medicaid expenditures. In theory, a decline in Medicaid expenditures among the low income groups could have been offset by this sharp increase in Medicare expenditures, with no net impact on transfers to lower income neighborhoods. However, Medicaid expenditure data by state and by year for home health care expenditures provides little support for this explanation. While Medicaid programs in Texas were spending more on recipients than in Texas in 1991 ($623 versus $74), by 1997 the spending levels had not changed appreciably ($647 per enrollee in New York, $146 in Texas). Source: http://www.cms.hhs.gov/statistics/nhe/state-estimates-residence/medicaid-per-capita50.asp

codes of the U.S.[17] Figure 2 tabulates average home health care spending for the 80+ population (the most common users of home health care) by year for the lowest income Decile 1, and for Deciles 5 and the highest income Decile 10. These are measures of spending *per Medicare enrollee* age 80 and older, and not restricted just to users of home health care. There was rapid growth in home health care expenditures for all income groups, but the growth for Decile 1 was particularly notable, rising to $1635 per elderly enrollee before dropping after 1997 when the Balanced Budget Act clamped down on unrestricted use.

How much of this spending benefited low income patients, either through improved survival or improved quality of life? In 1997, a report by the General Accounting Office suggested that 40% of all home health care costs were "inappropriate" (Havemann, 1997). In this case, inappropriate care included either fraud (e.g., a physician prescribing tests for sexually transmitted diseases to all of his home health care patients) or that the patient simply was not eligible for home health care. A recent paper by Robin McKnight (2004) did not find adverse health consequences caused by the sharp decline in home health care benefits in 1997, although there was a modest consequent increase in out-of-pocket medical expenses. In short, one should be cautious about attributing all dollar increases in Medicare expenditures to the people who nominally "receive" the benefit. (This is a basic message of fiscal incidence studies; the benefits do not necessarily flow to the people for whom the checks are written.) Home health care is not

[17] See Lee, McClellan, and Skinner (1999).

the only service provided during the 1990s that may have also benefited providers' bank accounts, but it was certainly the most visible.[18]

3. The Distribution of Survival Gains by Income

We next consider overall survival gains in the Medicare population. Here the sample includes not just the fee-for-service population but also the HMO enrollees; this is to avoid potential selection bias caused by healthier individuals joining managed care organizations. We consider two different cohorts from the Continuous Medicare History Survey. The first is the group of people age 65-69 and 75-79 alive in 1982, and the second is the corresponding group alive at age 1992. Figure 3 shows the percentage of the groups age 65-69 in the initial year who were still alive ten years later by sex and year of the cohort by income decile. There is a clear income gradient in both years; people living in higher zip code incomes were more likely to survive during both the 1980s and 1990s. A similar pattern is shown for those aged 75-79 in 1982 and 1992, detailed in Table 2, with life expectancy rising by more for men than for women. While all groups gained in terms of survival probabilities, the highest income groups gained the most, both in percentage and in absolute terms.

To quantify these changes in terms of the change in expected survival years, we chain together the two panels of 10 year survival curves for the younger and older cohorts, and estimate the change in expected survival years for a synthetic cohort over a 20 year period (from 65-69 to 85-89) with fixed weights for men and women based on

[18] Another cause for the rapid increase in health care expenditures during the 1990s was upcoding whereby hospitals switched patients from low-reimbursement to high-reimbursement diagnostic related groups (Silverman and Skinner, 2004) and effectively increased the price charged per Diagnostic-Related Group (DRG). Upcoding, which is distinguishable from "bracket creep" by the absence of supporting evidence for the more expensive coding, was curtailed sharply also around 1997 following well-publicized investigations of a large for-profit hospital chain.

the fraction of women in the age 65-69 cohort (54.8 percent). There was a 0.2 increase in expected life years in the bottom income decile, a 0.5 increase in the 5th decile, and a 0.8 increase in the top income decile.[19] When these life expectancy increases are "priced" at $100,000 per life year, the effects are large in magnitude, even after discounting.[20]

4. Inequality in the Provision of Effective Care

Here we focus on specific measures of effective care, considering first mammography rates among women age 65-69 in the Medicare population. The advantage of using mammography rates is that we have a time-series on rates of screening from 1993-2001 and so can measure changes over time in screening rates. A 5% sample of Part B physician claims data is used from 1993-1997, and a 20% sample from 1998-2001. The later 20% sample also includes outpatient clinic data as separate from physician data, these would include women who were screened in a clinic but not under the direct care of a physician. In theory, not including outpatient records for all years back to 1993 could bias our results, although as we show including mammography examinations performed in outpatient clinics has little effect on our results.

Figure 4 shows rates of screening by year for selected income deciles. There is a pronounced income gradient in screening rates that persists throughout the period. In 1993, the range in screening rates (between Decile 1 and Decile 10) was 16 percentage points, while in 2001, the range had shrunk slightly to 15 percentage points. A notable feature of the data is the sharp jump in rates between 1997 and 1998. This was most

[19] Another measure to quantify the changes over time is the concentration index, a variant of a Gini coefficient (Contoyannis and Forster, 1999). However, changes in the index were very small since we were just considering inequality in the over 65 population and not over the entire life-course.

[20] Recently there have been efforts to integrate changes in the value of health into an optimizing life cycle model, as in Becker, Philipson, and Soares (2003) or Berloffa, Brugiavini, and Rizzi (2003).

likely the consequence of removing the $100 coinsurance payment on January 1, 1998. It is surprising that rates for all income groups appear to have risen by about the same amount, given that low income households should be most sensitive to the relaxation of financial barriers to screening.

Similar results for the 1998-2001 period were also found in comparing rates of screening for eye examinations among patients with diabetics, another effective care measure to check for advanced damage to the vascular system caused by high blood glucose levels (available upon request from the authors). While encompassing a shorter time period, there was no evidence of trends in relative screening rates for diabetic eye examinations.

Of course, some part of the income-based differential could be the consequence of noncompliance; that is that lower income patients just don't show up for their screening appointment. We therefore consider physician directives or procedures performed in the first few days following acute myocardial infarction, where the primary goal of the physician is to keep the patient alive. Thus patient preferences (and even noncompliance) should play a very small role here. The measures of effective care for heart attack patients are derived from the Cooperative Cardiovascular Project (CCP) survey of approximately 160,000 AMI patients over age 65 in 1994/95. The survey information includes detailed clinical data from chart reviews along with treatment protocols. This allowed clinical researchers to determine from the chart data patients who were "ideal" for the use of the specific treatment; thus the right rate should be a number near 100 percent, regardless of health status, income, age, or any other characteristic. For this reason, we do not control for covariates or health indices, but consider simple averages by income decile.

Table 4 presents income-based differences in utilization of effective care along with the total sample size in the bottom row. Approximate 95% confidence intervals are presented at the bottom of the table; these apply to each of the means in the column because the deciles ensure equal sample sizes and the exact binomial confidence intervals are based on the average ratio. The first characteristic of these data are that in 1994/95, rates of utilization were remarkably low, hovering around 50 percent of ideal patients when the target rates should have been near 100 percent. The second characteristic is that higher income deciles are more likely to use effective treatments; rates rise from 40 percent in the bottom income decile to 47 percent in the top decile. There is a modest but significant difference in use of this effective care measure by income group.

One additional question is whether high income individuals are more likely to receive higher quality care because of treatment differences within regions, or because they are more likely to live in regions where overall effective care rates are higher (Chandra and Skinner, 2003). In Figure 5 utilization rates for ß Blockers are estimated with and without categorical regional variables. First, the previous results are replicated in a logistics regression coefficients converted to percentage screening rates (For significance levels in the linear context, see Table 4). State dummy variables are then introduced and the logistics regression is reestimated, again with odds ratios converted to probabilities, and shown in Figure 5. The adjusted probability of ß Blocker use holding constant the state of residence shows just a 3.6 percentage point difference by income group rather than a 7 percentage point difference. (In this latter regression, only the 8th and 10th decile coefficients were significantly different from zero.) That is, half of the income gradient here is the consequence of where patients live and not how patients are

treated within regions. The result does not generalize, however. A similar analysis for mammography screening and diabetic eye exams during 1998-2001 did not suggest any diminution in the effects of income on utilization rates after controlling for region of residence.[21]

In theory, we would like to know how the income gradient in ß Blocker use evolved over time. We have one observation from the survey in 1994/95. Since the use of ß Blockers for heart attack patients were rare before the early 1980s, we may safely infer that the observed difference in 1994/95 reflects a somewhat higher growth rate in the use of ß Blockers among the top income deciles until 1994/95. Since then, the designation of ß blocker use as a common quality measure has helped to increase compliance, but in many states they are still used for fewer than 70 percent of ideal patients even in 2001 (Jencks, 2003). It is possible that rates of compliance have risen more in low income regions, but Alabama was low in the use of ß Blockers in 1994/95 and it remains very low in 2001.

5. Conclusions and Discussion

While the income gradient in health is well established, the link between inequality in health care expenditures and inequality in health is not well established. This paper has considered these issues for the elderly population in the US by measuring changes over time in inequality in health care, and changes in health inequality, during the 1990s. There was a sharp divergence in the two trends. While Medicare expenditures grew by 78 percent among the lowest income neighborhoods during the period 1987-2001, the growth rate was just 34 percent in the highest income groups. The

[21] In this case, because the sample sizes were so much larger, we were able to use the 306 hospital referral regions (Wennberg and Cooper, 1999) as regional controls instead of states as in the analysis of ß blockers.

magnitude of the "twist" in Medicare expenditures during this period was $1410 per capita, which is comparable or larger than the per capita level of expenditures on many social welfare programs.

A different pattern was observed with regard to outcome measures. Life expectancy grew by 0.2 years for a typical 65-69 year old in the bottom income decile, and by 0.8 years in the top income decile. At face value, these results should create doubt that inequality in health care expenditures (and indeed, in health care more generally) should have a significant positive association with inequality in health outcomes. A more careful look at the expenditure data suggests that the lack of association between the two series is not entirely surprising. One might expect the strongest link between health outcomes and the utilization of efficacious health care. Because there does not appear to be an association between efficient or high-quality care, and overall Medicare expenditures, there is less reason to believe that the rapid increase in health care expenditures should have resulted in a dramatic reduction of health care inequality (also see Baicker and Chandra, 2004).

It should be cautioned that the magnitudes of the differences in effective care observed in the data would not be expected to exert a large impact on overall mortality rates. The impact on heart attack patients of a 7 percentage point increase in ß blocker use (i.e., the difference between the top and bottom income decile rate of use) is a 0.21 percentage point shift, or an overall impact on the general population of about 0.01 percent (since roughly 5 percent of the Medicare population experience a heart attack in

any year).[22]). If changes over time in health outcomes also result from new technologies where the presence of income- or education-based inequalities has also been noted (e.g., Lleras-Muney and Lichtenberg, 2002; Glied and Lleras-Muney, 2003; Goldman and Smith, 2002) the magnitude of these effects could be larger.

There are three important limitation of this study. The first is that in using outcome data, we have focused only on survival and not quality-adjusted or "healthy life years." To capture a more full measure of health, it would be necessary to include income-based differentials in treatments with proven effectiveness but for improving functioning rather than survival *per se*. Examples include hip or knee replacements for the treatment of osteoarthritis or the use of angioplasty for patients with ischemic heart disease. However, measuring true income-based differences is more difficult, given the necessity of adjusting for differential health needs (i.e., rates of osteoarthritis of the hip by income group) and for preferences (however defined) regarding surgical intervention.

Second, the study is limited to just the over-65 population. Focusing just on income-based differences in mammography rates within the Medicare program ignores the fact that Medicare itself contributes to a substantial increase in mammography rates at age 65 among those previously uncovered by insurance or in lower educational groups (Decker and Rapaport, 2002; Card, Dobkin, and Maestas, 2004). Measuring inequality within a specific age group ignores potential differences across age groups in overall inequality (Danziger, Haveman, and Smolensky, 1977).

[22] The 0.21 percent shift is derived by multiplying 7 percentage points times the implied 3 percentage point reduction in one-year mortality estimated by using an odds ratio (estimated for 30 day mortality) of 0.88 reported in Heidenrich and McClellan (2001).

Finally, we have not considered the financing side of the Medicare program. During the 1990s payments both rose and became more progressive as general income taxes became a larger source of revenue (McClellan and Skinner, 2003). The new prescription drug benefits passed into law in 2003 should also contribute to an increasing degree of redistribution to the extent the future growth in benefits are financed out of general tax revenue. Whether increased progressivity in the Medicare program would justify the increased longevity of higher income households is not entirely clear, however.

A sure approach to reducing inequality in overall health outcomes would be to increase utilization rates for effective (or quality) care to near 100 percent, which by definition would eradicate any income-based inequality in such care. Income-based inequality in health outcomes would likely persist because of other factors in social inequality, but such differences would not be exacerbated by inequality in health care. One could imagine "non-discrimination" rules like those developed for 401(k) pension plans in which hospitals or health care systems would experience a partial loss in Medicare funding if effective care measures for their low income patients fell too far below those for their high income patients.

References

Almond, Douglas, “"Is the 1918 Influenza Pandemic Over? Long-term Effects of *In Utero* Influenza Exposure in the Post-1940 U.S. Population" mimeo, National Bureau of Economic Research, 2003.

Auerbach, Alan, Jagadeesh Gokhale, and Laurence J. Kotlikoff, "Social Security and Medicare Policy from the Perspective of Generational Accounting," in J.M. Poterba (ed.) Tax Policy and the Economy 6. Cambridge: NBER and MIT Press (1992).

Baicker, Katherine, and Amitabh Chandra, “Medicare Spending, the Physician Workforce, and Beneficiaries’ Quality of Care” Health Affairs (April 7, 2004).

Battacharya, Jay, and Darius Lakdawalla, “Does Medicare Benefit the Poor? New Answers to an Old Question,” NBER Working Paper No. 9215 (revised, 2004).

Becker, Gary S., Thomas J. Philipson, and Rodrigo R. Soares, “The Quantity and Quality of Life and the Evolution of World Inequality,” NBER Working Paper No. 97645 (June 2003).

Berloffa, Gabriella, Agar Brugiavini, and Dino Rizzi, “Health, Income and Inequality: Evidence from a Survey of Older Italians,” University of Venice Working Paper (January 2003).

Bommier, A., and G. Stecklov, “Defining Health Inequality: Why Rawls Succeeds Where Social Welfare Theory Fails,” Journal of Health Economics 21(3) (2002): 497-514.

Card, David, Carlos Dobkin, Nicole Maestas, “The Impact of Nearly Universal Insurance Coverage on Health Care Utilization and Health: Evidence from Medicare,” NBER Working Paper No. 10365 (March 2004).

Case, Anne, and Angus Deaton, “Broken Down By Work and Sex: How Our Health Declines,” NBER Working Paper No. 9821 (July 2003).

Chandra, Amitabh, and Jonathan Skinner, “Geography and Racial Disparities in Health,” NBER Working Paper (February 2003).

Contoyannis, Paul, and Martin Forster, “The Distribution of Health and Income: A Theoretical Framework,” Journal of Health Economics 18(5) (1999): 605-622.

Contoyannis, Paul, and Andrew M. Jones, “Socio-Economic Status, Health, and Lifestyle,” Journal of Health Economics (2004, forthcoming).

Culyer, A.J., Eddy van Doorslaer, and Adam Wagstaff, "Comment: Utilisation as a measure of equity by Mooney, Hall, Donaldson, and Gerard," Journal of Health Economics 11 (1992): 93-98.

Cutler, David, Mark McClellan, Joseph Newhouse, and Dahlia Remler, "Pricing Heart Attack Treatments," Quarterly Journal of Economics 113(4) (November 1998), 991-1024.

Danziger, Sheldon, Robert Haveman, and Eugene Smolensky, "The Measurement and Trend of Inequality: Comment," American Economic Review 67(3) (June 1977): 505-512.

Davis, Karen, and Roger Reynolds, "Medicare and the Utilization of Health Care Services by the Elderly," Journal of Human Resources 10(3): 361-77 (1975).

Deaton, Angus, and Christina Paxson, "Mortality, Income, and Income Inequality Over Time in Britain and the United States," NBER Working Paper No. 8534 (October 2001).

Decker, Sandra, and Carol Rapaport, "Medicare and Disparities in Women's Health," NBER Working Paper No. 8761 (February 2002).

Elstad, Jon Ivar, and Steinar Krokstad, "Social Causation, Health-Selective Mobility, and the Reproduction of Socioeconomic Health Inequalities Over Time: Panel Study of Adult Men," Social Science and Medicine 57 (2003): 1475-1489.

Fisher, Elliott S., David Wennberg, Therese Stukel, Daniel Gottlieb, F.L. Lucas, and Etoile L. Pinder, "The Implications of Regional Variations in Medicare Spending. Part 1: The Content, Quality, and Accessibility of Care," Annals of Internal Medicine 138(4) (February 18, 2003a): 283-287.

Fisher, Elliott S., David Wennberg, Therese Stukel, Daniel Gottlieb, F.L. Lucas, and Etoile L. Pinder, "The Implications of Regional Variations in Medicare Spending. Part 2: Health Outcomes and Satisfaction With Care" Annals of Internal Medicine 138(4) (February 18, 2003b): 288-299.

Fuchs, Victor, "The Financial Problems of the Elderly: A Holistic Approach," NBER Working Paper No. 8236 (April 2001).

Fuchs, Victor, "Provide, Provide: The Economics of Aging" NBER Working Paper No. 6642 (July 1998).

Gakidou, E.E., C.J.L. Murray, and J. Frenk, "Defining and Measuring Health Inequality: An Approach Based on the Distribution of Health Expectancy," Bulletin of the World Health Organization 78(1) (2000): 42-54.

Geronimus, Arline, John Bound, and Lisa Neidert, "On the Validity of Using Census Geocode Characteristics to Proxy Individual Socioeconomic Characteristics," Journal of the American Statistical Association 91(434): 529-537 (1996).

Gittelsohn, Alan M., Jane Halpern, and Ricardo L. Sanchez, "Income, Race, and Surgery in Maryland," American Journal of Public Health 81(11) (November 1991): 1435-41.

Glied, Sherry, and Adriana Lleras-Muney, "Health Inequality, Education, and Medical Innovation," NBER Working Paper No. 9738 (May 2003).

Glover, J. A., "The Incidence of Tonsillectomy in School Children," Proceedings of the Royal Society of Medicine 31 (1938): 1219-1236.

Goldman, D.P and J.P. Smith. 2002. "Can Patient Self-Management Help Explain the SES Health Gradient?" Proceeding of the National Academy of Sciences of the United States of America 99(16): 10929-10934.

Gornick, Marian E., Paul Eggers, Thomas Reilly, Renee Mentnech, Leslye Fitterman, Lawrence Kucken, and Bruce Vladeck, "Effects of Race and Income on Mortality and Use of Services Among Medicare Beneficiaries," New England Journal of Medicine 335: 791-799 (1996).

Graham, Heather, "Building an Inter-Disciplinary Science of Health Inequalities: The Example of Lifecourse Research," Social Science and Medicine 55 (2002): 205-2016.

Havemann, Judith, "Fraud is Rife in Home Care for the Elderly; Medicare Investigators Find 40% of Services Unjustified," The Washington Post (July 29, 1997) p. A01.

Heidenreich, Paul A., and Mark McClellan, "Trends in Treatment and Outcome for Acute Myocardial Infarction: 1975-1995," American Journal of Medicine 110 (2001): 165-74.

Ibrahim, S.A., L.A. Siminoff, C.J. Burant, and C.K. Kwoh, "Variations in Perceptions of Treatment and Self-care Practices in the Elderly with Osteoarthritis: A Comparison Between African American and white Patients," Arthritis and Rheumatism 45 (2001): 340-45.

Ibrahim, S.A., L.A. Siminoff, C.J. Burant, and C.K. Kwoh, "Understanding Ethnic Differences in the Utilization of Joint Replacement for Osteoarthritis," Medical Care 40 (Suppl 1) (2002): I44 – I55.

Jencks, Stephen F., Edwin D. Huff, and Timothy Cuerdon, "Change in the Quality of Care Delivered to Medicare Beneficiaries," JAMA 289(3) (January 15, 2003), 305-312.

Katz, Jeffrey N., "Patient Preferences and Health Disparities," JAMA 286 (2001): 1506-9

Le Grand, Julian, "The Distribution of Public Expenditure: The Case of Health Care," Economica 45(178) (May 1978): 125-142.

Le Grand, Julian, The Strategy of Equality. London, George Allen & Unwin (1982).

Le Grand, Julian, "The Distribution of Health Care Revisited: A Commentary on Wagstaff, van Doorslaer and Paci, and O'Donnell and Propper," Journal of Health Economics 10 (1991): 239-245.

Lee, Julie, Mark McClellan, and Jonathan Skinner, "The Distributional Effects of Medicare Expenditures," in J. Poterba (ed.) Tax Policy and the Economy 13 (1999)

Link, Charles R., Stephen H. Long, and Russell F. Settle, "Equity and the Utilization of Health Care Services by the Medicare Elderly," Journal of Human Resources 17(2) (1982): 195-212.

Lleras-Muney, Adriana, and Frank R. Lichtenberg, "The Effect of Education on Medical Technology Adoption: Are the More Educated More Likely to Use New Drugs?" NBER Working Paper No. 9185 (September 2002).

Lubitz, James, and Gerald Riley, 1993, "Trends in Medicare Payments in the Last Year of Life," New England Journal of Medicine 331: 1092-1096.

McClellan, Mark, and Jonathan Skinner, "The Incidence of Medicare." Mimeo, Dartmouth College (2004).

McDermott, W. "The Public Good and One's Own." Perspectives in Biology and Medicine 21 (1978): 167-188.

McKnight, Robin, "Home Health Care Reimbursement, Long-Term Care Utilization, and Health Outcomes," NBER Working Paper No. 10414 (April 2004).

Moon, Marilyn, "The Economic Welfare of the Aged and Income Security Programs," in M. Moon and E. Smolensky (eds.) Improving Measures of Economic Well-Being. New York: Academic Press (1977).

Mooney, Gavin, Jane Hall, Cam Donaldson, and Karen Gerard, "Utilisation as a Measure of Equity: Weighing Heat?" Journal of Health Economics 10 (1991): 475-480.

Morris, Stephen, Matthew Sutton, and Hugh Gravelle, "Inequity and Inequality in the Use of Health Care in England: An Empirical Investigation," Center for Health Economics Technical Paper No. 27, The University of York (December 2003).

Pappas, G., et al., "The Increasing Disparity in Mortality Between Socioeconomic Groups in the United States," New England Journal of Medicine 329: 103-109 (1993).

Preston, Samuel, and Paul Taubman, "Socioeconomic Differences in Adult Mortality and Health Status," in Linda G. Martin and Samuel Preston (eds.) Demography of Aging (Washington DC: National Research Council and the National Academy Press) (1994).

Reynolds, M., and E. Smolensky, Public Expenditures, Taxes, and the Distribution of Income: The U.S., 1950, 1961, 1970. (New York: Academic Press, 1977).

Ross, Christine M., Sheldon Danziger, and Eugene Smolensky, "Interpreting Changes in the Economic Status of the Elderly, 1949-79," Contemporary Policy Issues 5 (April 1987): 98-112.

Sassi, F., L. Archard, and J. Le Grand, "Equity and the Economic Evaluation of Healthcare." *Health Technology Assessments* 5(3) (2001): 1-130.

Skinner, Jonathan, and Douglas Staiger, "The Diffusion of Health Care Technology," Mimeo, Dartmouth College (May 2004).

Skinner, Jonathan, Douglas Staiger, and Elliott Fisher, "Is Technological Change in Health Care Always Worth It? The Case of Acute Myocardial Infarction," mimeo, Dartmouth Medical School (May 2004).

Short, Kathleen, and Thesia I. Garner, "Experimental Poverty Measures Under Alternative Treatments of Medical Out-of-Pocket Expenditures: An Application of the Consumer Expenditures Survey." U.S Census (May 28, 2002).

Silverman, Elaine, and Jonathan Skinner, "Hospital Ownership and Medicare Upcoding," Journal of Health Economics (March, 2004).

Smith, James, "Unraveling the SES-Health Connection," mimeo, RAND Corporation (September 2003).

Smolensky, Eugene, Leanna Stiefel, Maria Schmundt, and Robert Plotnick, "In-Kind Transfers and the Size Distribution of Income," in M. Moon and E. Smolensky (eds.) Improving Measures of Economic Well-Being. New York: Academic Press (1977).

van Doorslaer, E., et. al., "Income–Related Inequalities in Health: Some International Comparisons," Journal of Health Economics 16 (1997): 92-112.

Wagstaff, Adam, Eddy van Doorslaer, and Pierella Paci, "On The Measurement of Horizontal Inequity in the Delivery of Health Care," Journal of Health Economics 10 (1991): 169-205.

Wagstaff, Adam, and Eddy van Doorslaer, "Overall versus Socioeconomic Health Inequality: A Measurement Framework and Two Empirical Examples," Health Economics 13 (2004): 297-301.

Walter, Louise C., Natalie P. Davidowitz, Paul A. Heineken, and Kenneth E. Covinsky, "Pitfalls of Converting Practice Guidelines into Quality Measures: Lessons Learned From a VA Performance Measure," JAMA 291 (20) (May 26, 2004): 2466-2470.

Wennberg, John E., and Megan M. Cooper, The Dartmouth Atlas of Health Care. Chicago: American Hospital Association (1999).

Wennberg, John E., Jonathan Skinner, and Elliott Fisher, "Geography and the Debate Over Medicare Reform," Health Affairs (February 2002).

Table 1: Medicare Expenditures by Year and Zip Code Income Decile

	Decile 1	Decile 3	Decile 5	Decile 8	Decile 10
1987	3346	3159	3228	3478	3588
1988	3548	3309	3343	3556	3656
1989	3926	3619	3590	3817	3980
1990	4068	3637	3698	3904	3970
1991	4265	3852	3811	4050	4022
1992	4457	4039	3914	4119	4123
1993	4740	4140	4102	4199	4219
1994	5365	4553	4465	4432	4464
1995	5743	4736	4702	4605	4611
1996	5998	4931	4804	4596	4675
1997	6120	5073	4778	4651	4666
1998	6337	5311	5031	4804	4908
1999	6153	5299	5002	4719	4946
2000	5895	5068	4885	4614	4725
2001	5970	5080	4873	4574	4802
Dollar Change, 1987-2001	2624	1921	1645	1096	1214
Percentage Change, 1987-2001	78.4	60.8	51.0	31.5	33.8

Source: Medicare Continuous History Survey. Controls for age and sex. All expenditures expressed in $2001.

Table 2: 10-Year Survival Probabilities
By Age and Sex: 1982-91 and 1992-2001

	Male		Female		Male		Female	
Income Decile	Age 65-69				Age 75-79			
	82-91	92-01	82-91	92-01	82-91	92-01	82-91	92-01
1	59.0	61.9	75.8	75.4	34.6	35.1	51.2	51.8
2	61.5	64.3	77.5	77.4	35.3	36.5	53.3	53.1
3	62.0	66.0	77.8	78.7	35.0	37.6	53.6	54.1
4	63.2	67.2	79.2	79.2	34.8	37.6	53.8	55.0
5	64.1	68.2	77.9	79.4	36.0	39.7	53.9	55.1
6	64.5	68.9	78.8	79.8	36.1	39.8	53.9	54.8
7	64.6	69.7	79.0	80.4	35.4	39.9	53.8	55.7
8	65.8	70.9	79.4	80.7	37.3	41.0	54.1	56.2
9	66.5	72.5	79.8	81.8	38.2	42.9	54.1	56.3
10	69.2	74.8	81.1	83.4	38.7	44.8	54.7	57.1
Sample	188,177	217,272	229,308	263,093	98,053	126,011	152,606	187,554
Source: Author's calculations from Medicare Claims Data								

Table 3: Mammography Rates by Year and Zip Code Income Decile
(Rates Including Outpatient Clinics in Parentheses, 1998-2001)

	Decile 1	Decile 3	Decile 5	Decile 8	Decile 10
1993	20.7	25.9	28.2	30.6	34.6
1994	22.8	28.3	30.1	32.2	35.7
1995	24.0	30.1	31.7	33.0	36.8
1996	23.8	29.0	30.0	32.4	36.1
1997	24.7	29.3	31.6	33.3	37.1
1998	32.0 [34.8]	39.5 [42.0]	41.0 [43.9]	43.5 [45.7]	46.7 [48.5]
1999	34.3 [36.8]	41.9 [44.2]	43.6 [45.8]	45.4 [47.5]	48.1 [49.8]
2000	34.6 [36.9]	42.6 [44.8]	44.7 [46.6]	45.9 [47.8]	48.3 [49.9]
2001	36.5 [38.5]	44.0 [45.9]	45.3 [47.0]	47.0 [48.5]	49.4 [50.7]
Change: 1993-2001	15.8	18.1	17.0	16.4	14.8
Change: 1997-2001	11.7	14.7	13.7	13.7	12.3

Source: Medicare Continuous History Survey. Controls for age and sex. All expenditures expressed in $2001. The rates inclusive for outpatient clinics are presented in brackets. For Decile 10 in 1998, the rate is slightly lower inclusive of outpatient clinics because of a slightly different definition of the denominator.

Table 4: Rates of Effective Care for Acute Myocardial Infarction 1994/95: by Income Decile

Zip Code Income Decile	Beta Blocker Use at Discharge*	Ace Inhibitor At Discharge**	Reperfusion within 12 Hours	Smoking advice given***
1	40	57	32	33
2	39	57	32	35
3	43	60	33	34
4	45	59	33	35
5	45	59	34	37
6	44	57	35	34
7	45	59	37	34
8	47	59	37	37
9	45	59	36	35
10	47	59	37	35
Approx. 95% Conf. Interval	±1.4	±2.2	±1.7	±2.3
Sample size	50,156	19,286	32,097	17,151

Source: Cooperative Cardiovascular Project.
* Universe: appropriate (beta blocker) or eligible (for reperfusion).
** Universe: ideal patients
*** Universe: smokers

Figure 1: Medicare Expenditures by Income Decile, 1987-2001

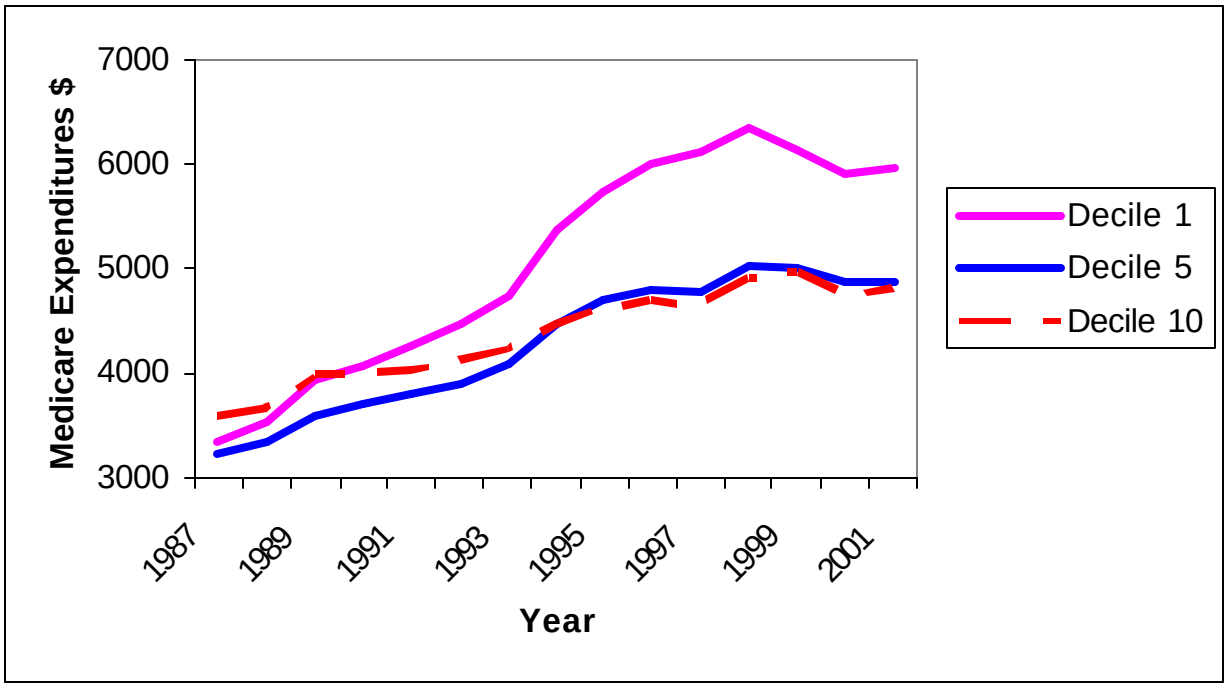


Figure 2: Home Health Care Expenditures by Income Decile, 1987-2001
Age 80+

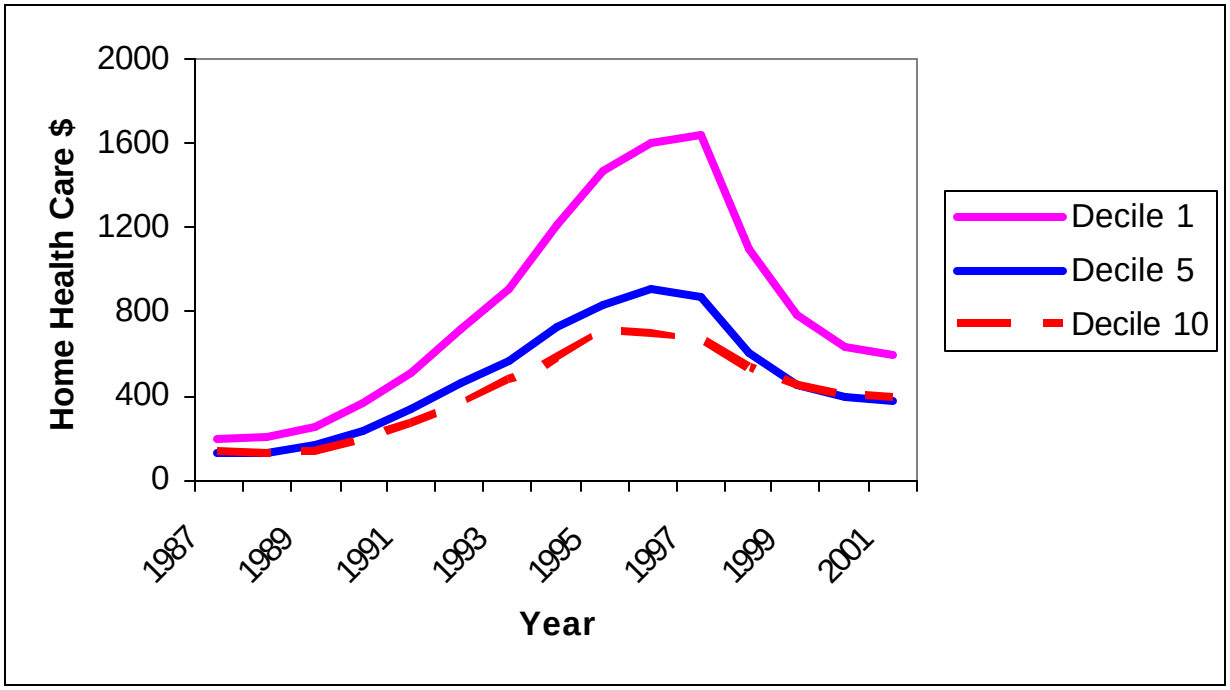


Figure 3: 10-Year Survival Rates For Age 65-69 Cohorts By Sex: 1982-91 and 1992-2001

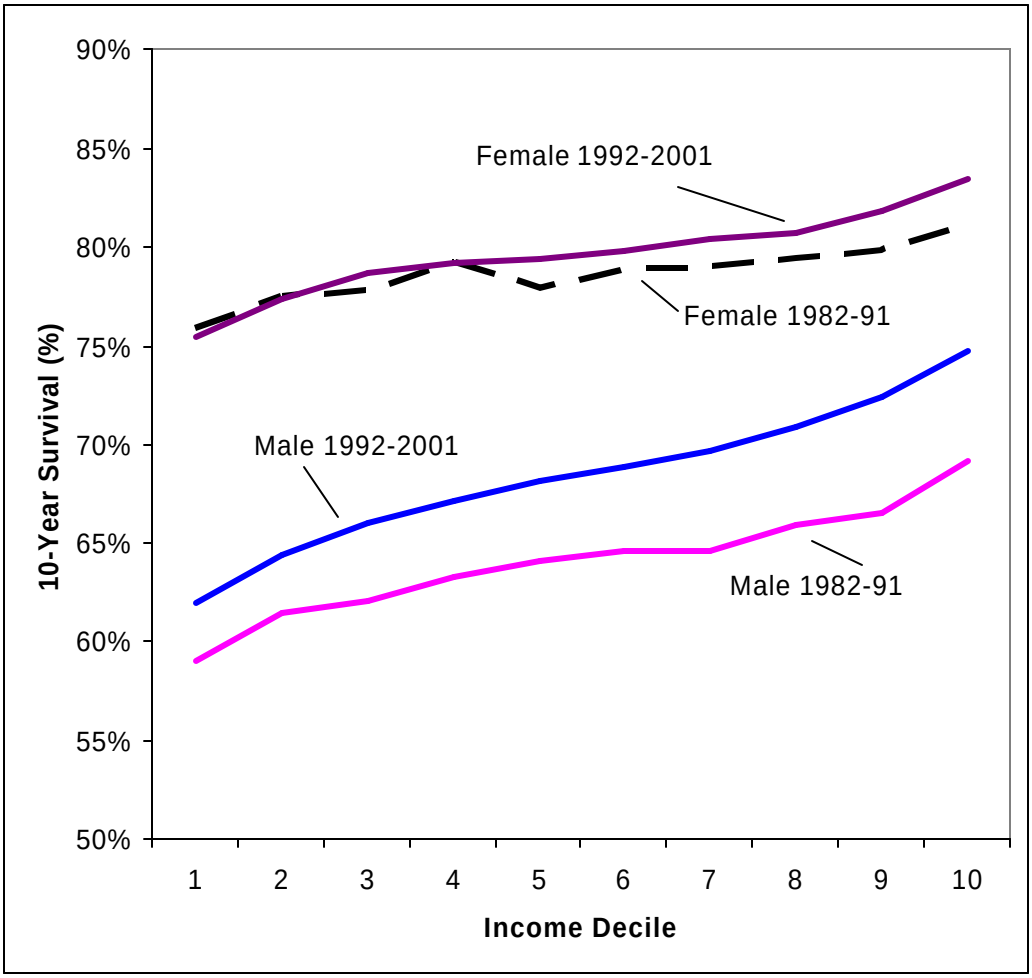
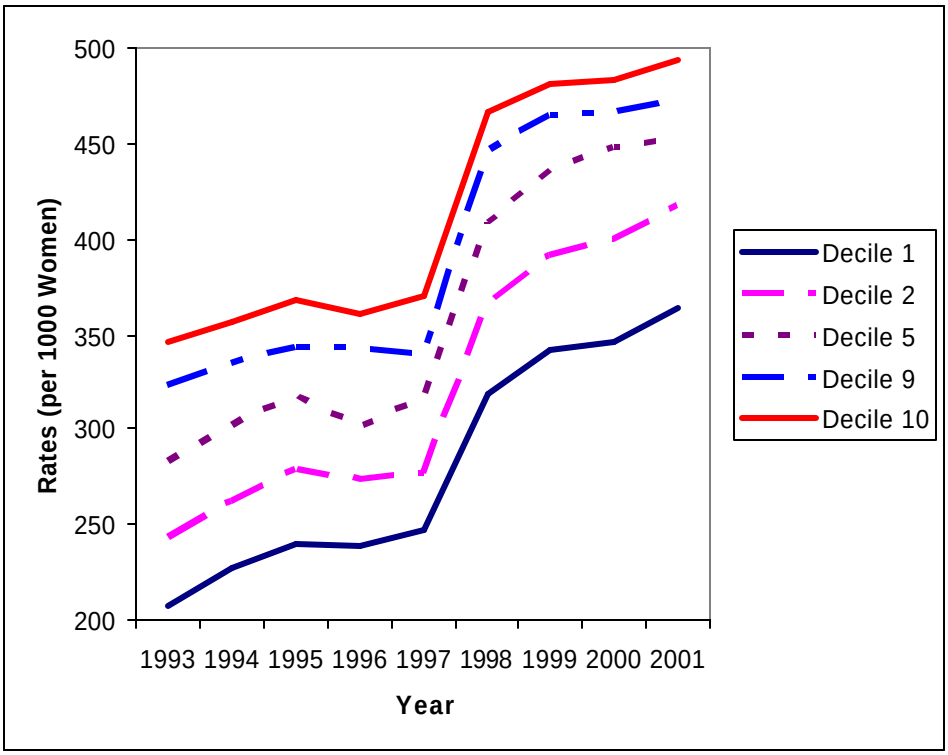


Figure 4: Change in Mammography Rates 1993-2001 By Zip Code Income Decile



Note: Rates per Females Age 65-69. The 100 dollar coinsurance rate was removed on 1 January 1998.

Figure 5: Estimates of the Income Gradient for the Use of ß Blockers for Ideal Patients: With and Without State-Level Controls, 1994/95